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**BIOLOGY**

**0610/43**

Paper 4 Theory (Extended)

**October/November 2016**

MARK SCHEME

Maximum Mark: 80

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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**Abbreviations used in the Mark Scheme:**

- ; separates marking points
- / alternatives
- I ignore
- R reject
- A accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording
- AVP any valid point
- ecf credit a correct statement / calculation that follows a previous wrong response
- **ora** or reverse argument
- ( ) the word / phrase in brackets is not required, but sets the context
- underline actual words given must be used by the candidate (or grammatical variants of them)

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
1(a)(i)	<b>A:</b> vagina; <b>B:</b> oviduct/Fallopian tube; <b>D:</b> sperm/male gamete;	<b>3</b>	
1(a)(ii)	to remove, egg cells/ova/female gametes;	<b>1</b>	
1(b)(i)	follicle stimulating hormone/FSH; luteinizing hormone/LH;	<b>1</b>	
1(b)(ii)	start of new cycle/days 1–10/during menstruation/AW;	<b>1</b>	
1(b)(iii)	<b>X</b> positioned anywhere in uterus (wall/lining);	<b>1</b>	
1(c)	<ol style="list-style-type: none"> <li>1 allows infertile couples/single parents/same sex couples (to have children);</li> <li>2 religious/legal/moral/ethical, concerns about IVF;</li> <li>3 may not treat infertility successfully;</li> <li>4 expense of fertility treatment;</li> <li>5 may lead to multiple births;</li> <li>6 <i>idea of</i> genetic screening before implanting is possible;</li> <li>7 storage of, eggs/embryos, is possible (during chemotherapy);</li> <li>8 qualification of an religious/ethical/legal/moral, issue;</li> <li>9 has allowed stem cell research on embryos;</li> <li>10 AVP;</li> </ol>	<b>4</b>	<p><b>A</b> high chance of miscarriage/stress</p> <p><b>A</b> cost to health services/cost means restricted availability</p>
		<b>Total: 11</b>	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
2(a)	1 enzymes are proteins; 2 enzymes can be reused / are unchanged in a reaction; 3 enzymes are specific; 4 (enzymes are) catalyst / speeds up reaction; 5 lowers (activation) energy needed for the reaction; 6 successful collisions; 7 enzyme-substrate complex / ESC; 8 <u>active site</u> ; 9 (enzyme and substrate) complementary shape / AW; 10 ref. to <u>optimum</u> , temperature / pH; 11 too much heat results in denatured enzymes; 12 too little kinetic energy / heat, less (successful) reactions; 13 incorrect pH results in denatured enzymes; 14 (substrate) is <u>pectin</u> / cell wall; 15 results / product, is clear juice; 16 mass / cheaper / more (volume) / yield, juice production;	<b>6</b>	<b>R</b> cellulose
2(b)	read at eye level / avoid error of parallax; read bottom of meniscus; place measuring cylinder on a level / flat, surface; remove funnel / ensure all drops have fallen to the bottom;	<b>2</b>	<b>A</b> parallel / horizontal to meniscus
2(c)(i)	19 ÷ 10 <b>or</b> 17.5 ÷ 10; 2 (cm <sup>3</sup> per min);	<b>2</b>	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
2(c)(ii)	<b>A</b> / 0.5 (cm <sup>3</sup> cubes); large(st) surface area (to volume);	<b>2</b>	<b>A</b> smallest cubes
		<b>Total: 12</b>	

<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
3(a)	human / largest mammal, has the longest / bat has the shortest (small intestine); (small intestine of) rat and cat are very similar in length; comparative data, quote / calculation with units at least once; negative correlation between length and length relative to body mass;	<b>3</b>	<b>A</b> relative to body mass bat much larger than other three animals / smallest length relative to body mass is in humans
3(b)	movement into / out of / through, (epithelial) cells / villi; into, capillaries; across cell membranes; by active transport; through protein carriers; against a concentration gradient; using energy;	<b>3</b>	<b>I</b> walls <b>I</b> into blood
3(c)(i)	(insect-eating) bat;	<b>1</b>	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
3(c)(ii)	ratios are higher in the duodenum; higher (inner) surface area (than ileum); data comparison (for any one animal); more villi; more microvilli;	<b>3</b>	
3(d)	<u>emulsification</u> ; increased surface area of fat (globules); faster, digestion / break down (of fat by enzymes); by lipase / to fatty acids <u>and</u> glycerol; neutralises (stomach) acid / chyme; provides alkaline medium for, pancreatic enzymes / lipase; denatures, pepsin / stomach, enzymes; AVP;	<b>4</b>	I faster break down of fats unqualified
		<b>Total: 14</b>	

<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
4(a)	(nicotine is) a (chemical) substance taken into the body; that modifies / affects / influences, (chemical reactions in) the body; addictive / can cause withdrawal symptoms (when stopped) / AW;	<b>2</b>	

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Question	Answer	Mark	Guidance
4(b)	<p><i>carbon monoxide:</i> binds to haemoglobin (permanently); Accept carboxyhaemoglobin reduced oxygen (transport);</p> <p><i>tar (max 3):</i> carcinogenic / causes lung cancer; sticks to / blocks / damages, alveoli / cilia; produce more mucus; making prone to (named) respiratory infections; reduced, diffusion / gas exchange;</p>	4	A irritates, gas exchange surface / airways / emphysema
4(c)(i)	<ol style="list-style-type: none"> <li>1 more men smoked (between 1950–1998 than women); ORA</li> <li>2 both decrease overall / between 1950 and 1998;</li> <li>3 (overall) drop in men is more (than in women); ORA Ignore data</li> <li>4 (1950)–<u>1970</u>: men decreasing and women increasing;</li> <li>5 <u>1970</u> onwards : both genders decreasing;</li> <li>6 larger difference in numbers / %, before 1970s / earlier OR smaller difference in numbers / %, after 1970s / later; AW</li> <li>7 maximum (implied) for women was 50% and 82% for men;</li> <li>8 comparative data quote between men and women with units stated once;</li> </ol>	4	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
4(c)(ii)	number of deaths by (lung) cancer shows similar trend as percentage smokers; (correlation) in both men and women / AW; lag in the death rate trend (compared with smokers) / AW; relevant data quote from both graphs; trend more obvious in men / death rate in women is increasing overall; impossible to show conclusive link; (because) cannot control experimental conditions / other lifestyle factors; AVP;	<b>4</b>	e.g. lag in/ drop of 7–8 years in men
4(d)	toxins / AW, in smoke can cross the placenta; increased risk, of miscarriage / still birth / premature birth / low birth weight / deformities; reduces oxygen available to the foetus / foetal brain damage; increased risk, of reduced lung, function / infection, in foetus / infants; babies more likely to become addicted / have withdrawal symptoms; AVP;	<b>3</b>	
		<b>Total: 17</b>	



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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
5(a)(i)	<u>double helix</u> ; (strands) contain, bases / A and T and C and G; A joins with T / C joins with G; strands / bases, join / pair up, by crosslinks / hydrogen bonds; AVP;	<b>3</b>	<b>A</b> labelled drawing or description
5(a)(ii)	codes for a <u>protein</u> ;	<b>1</b>	
5(b)	respiration; aerobic (respiration); release energy / make ATP;	<b>2</b>	<b>R</b> produce energy
5(c)	cytoplasm; cell membrane; single celled / unicellular; no (true) nucleus / no nuclear membrane; loop of DNA / chromosome / naked DNA; no, (membrane-bound) organelles / mitochondria / chloroplasts; (peptidoglycan / murein) cell wall; AVP; e.g. plasmids	<b>2</b>	<b>A</b> nucleoid  <b>R</b> cellulose cell wall <b>I</b> flagella, pili, mesosomes, capsules
5(d)	<b>B</b> and <b>D</b> in box 1 and 2 (any order); <b>C</b> in box 3; <b>A</b> and <b>F</b> in box 6 and box 7 (any order);	<b>3</b>	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
5(e)	it is (more) accurate (than traditional classification systems); easi(er)/cheap(er)/quick(er)/(more) efficient/to use (than other (named) identification methods); <b>ora</b> allows large-scale identification (of many species simultaneously); only trace samples are required; (DNA sequences) within a species are very similar;	<b>1</b>	<b>A</b> samples do not need to purified <b>A</b> early identification of (pathogenic bacteria) for infections
		<b>Total: 12</b>	

<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
6(a)	(branching) veins; <b>ora</b> shape/broad (leaves); <b>ora</b>	<b>1</b>	<b>I</b> petioles
6(b)	it is (made of a group of) tissues working together to perform specific function(s);	<b>1</b>	
6(c)	$6\text{CO}_2 + 6\text{H}_2\text{O}$ (LHS); $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (RHS); energy/light/chlorophyll;	<b>3</b>	
6(d)(i)	palisade (mesophyll/tissue/cells/parenchyma); tightly packed/contain many chloroplast/stacked upright;	<b>2</b>	<b>A</b> lots of chlorophyll
6(d)(ii)	(upper) epidermis/epidermal cells; transparent/allows light to pass through/thin;	<b>2</b>	

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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	<b>Guidance</b>
6(d)(iii)	spongy, mesophyll / tissue / cells / parenchyma / layer; air spaces / loosely packed / gas exchange / diffusion of gases;	<b>2</b>	Mark points are not linked
6(e)	nitrates are useable source of nitrogen; needed to make amino acids; (amino acids) to make proteins; <u>protein</u> / <u>DNA</u> , needed for growth; to make DNA / RNA / nucleotides / bases; other suitable named use of organic nitrogenous compounds found in plants;	<b>3</b>	
		<b>Total: 14</b>	